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1853

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Paste and Enamel Buttons.

LETTERS PATENT to Constant Jouffroy Duméry, of Paris, in the Empire of France, and of 16, Castle Street, Holborn, in the County of Middlesex, for the Invention of " IMPROVEMENTS IN THE MANUFACTURE OF PASTE AND ENAMEL BUTTONS."

Sealed the 14th October 1853, and dated the 14th April 1853.

PROVISIONAL SPECIFICATION left by the said Constant Jouffroy Duméry at the Office of the Commissioners of Patents, with his Petition, on the 14th April 1853.

I, CONSTANT JOUFFROY DUMÉRY, of Paris, in the Empire of France, and of 16, Castle Street, Holborn, in the County of Middlesex, do hereby declare the nature of the said Invention for " IMPROVEMENTS IN THE MANUFACTURE OF PASTE AND ENAMEL BUTTONS" to be as follows :—

My machines are of two kinds : first, for manufacturing several buttons at a time ; and, secondly, for manufacturing but one button at each stroke.

In all machines that have been used for the manufacture of paste buttons, all the operations are made successively at the same point, and require a considerable time for the manufacture of one button.

In order to obtain greater rapidity the number of moulds is increased :

this renders the apparatus expensive. I have surmounted many difficulties by suppressing the points for the piercing of the holes, and by dividing the operations thus:—Supposing the lower part B, of the tool A, B, Fig. 1, Sheets 1, and 7, brought under a distributor C, placed at the lower part of the sieve D, containing the pulverized matter, and furnished internally with a circular agitator E, and with vertical stuffers F, having simultaneously a rectilineal and rotary motion. If the circular agitator work continuously, to prevent the cavities that might be made in the plastic matter by their eccentric motions, and conduct the matter facing a hole or aperture made in the slide *c*, and corresponding to the lower parts of the moulds, the cavities in the slide *c*, are filled with metal that is not compressed, but equally distributed. When the slide has passed over the part *c*′, and *c*‴, the holes *d*, then face the openings of the same dimension, made in the plates surrounding the slide. A slight pressure on the cleaning reed G, will free the slide of the matter it contains, which is received at the lower part *b*, *b*. The matter ought to be likewise distributed by a circular distributor, having its lower part under the sieve. If, while the lower part *b*, *b*, is being supplied with paste, the upper part *a*, *a*, containing the button previously struck, to be transferred from the opposite side, and that a pressure be made by the part H, which causes the buttons to fall on a moveable plate I, in consequence of a slight motion given to *a*, *a*, of the upper stamp. The striking operation is made by obtaining a pressure by a lever or screw, when the two parts of the mould are facing each other. The joint dividing horizontally the neck or collar *a*, *a*, and *b*, *b*, of the mould, one of the two halves of this collar remains constantly round the lower part, while the other half is attached to the upper part, and by the joint of the collar the charging and throwing off may be made simultaneously. The charging of a part is prepared in the distributor, while the striking and the reception of the matter are made by horizontal rectilineal motion given to the receiving plate I. My mode of striking differs likewise from the usual mode, by the elasticity given to the points by the levers B′, thus equalising the pressure, so that if, notwithstanding the precautions with the distributor, there existed any inequalities in the charging, the

1853

pressure on the button would always be equal, whatever its thickness might be ; thus fewer buttons are spoiled.

My mechanism has less wear and tear. The operation of piercing is made simultaneously (by my machine) ; thus the upper portion of the tool A, A, though it cannot be fixed to N, is adjusted at all the parts where the metals come into contact, and is furnished at the different parts where it is joined with vulcanized india-rubber stuffing or washers K, K, so that at the moment the pressure is made it becomes air tight. The drilling tools are pierced at the points forming the holes in the buttons; these holes cross equally, the plate bearing the drilling tools; and it is in a cavity made round these holes that the india-rubber stuffing is inserted; similar holes are made in a hollow prism V^1, placed under the pressing plate. Each extremity of this prism is provided with a valve box, bearing a tube, to which is adapted a jointed or elastic pipe, having the other extremity fixed to a recipient, in which is an air pump or air compressing machine, establishing a current of air sufficiently strong to clear the holes by blowing. The air contained in the recipient and in the pipe is stopped at the entrance of the prism, by the valve, on which it causes a pressure; and it is only at the moment that the operation of pressing the mould is at its greatest intensity that the valves being displaced by the lower eccentrics O^1, the air rushes into each of the holes with the rapidity it has on issuing from an air gun, and produces a perforation of the buttons without altering the angles of the mould. The piercing operation by means of air might also be made by hollow pressing plate, in which one or several pistons would constantly compress the air, or even the simple depression caused by the vacuum made on the side, that the clearing of the holes might be effected.

DESCRIPTION OF SHEETS 7, 8, 9, 10.

Fig. 1, front elevation of the machine ; 2, vertical section, through the line A, B. This Figure shows the curves of the several eccentrics giving the motions. Fig. 3, section through the line C, D, of Fig. 2, showing the details of the tool. Fig. 4, horizontal projection of the machine.

Supposing half of the sieve D, to be taken away, so as to show the whole of the tool, Fig. 5, horizontal section, half through E, F, that is to say, supposing the upper part of the tool to be taken away, and that the other half through G, H, that is to say, through the axis of the two-kneed shaft. A, A, upper part of the tool, to which the piercing plate is adapted. B, B, lower part of the tool, in which the counter piercers are inserted. B′, dinamometrical lever, at the extremity of which the pressure is made. *a*, *a*, upper portion of the jointed collar. *a*′, upper moulds. *b*, lower moulds. *b*, *b*, lower half of the jointed collar. *c*, distributing slide, worked by the parts *c*′, acting on the slide in the direction *b*, *c*, and not in the direction *c*, *b*. C′, are springs, which bring the slide to its former position. D, sieve, into which the powder is thrown. E, circular agitator. F, small agitator. F′, pinion on the axis of the agitator. Q, toothed wheels, forming grooved eccentrics, working the agitator, the small agitators raising the upper part of the tool. The unstuffing tool, the compressing agents for the deposit of the buttons on the plates, the traveller or car bringing the plate and the valves for the piercing of the buttons. Q′, toothed wheel, forming grooved eccentrics, working the chains for advancing the plates; the cross piece raising the plate, the inclined plane for the cam K′. F″, vertical rack working the circular agitator. G, a cross beam, kept in place by the rod *g*. H, compressing rod crossing to effect the deposit of the buttons on the plates. H′, H′, lever, jointed at the point H″, and receiving its motion from the cam *h*″, *h*″, *h*″. I, sliding plates. *i*, endless chain, bearing the plates I′, not having a rotary motion, by the arrangement I″, the lever I‴, and the cams V, V, V. J, traveller, bearing the plates on which the buttons are deposited. J′, J′, cranks and levers, working the traveller J, and receiving their motion by the cams J′, J′, J′: these cams are only brought into motion every eight turns; in the other turns the roller follows the circular groove *j*″, *j*″, *j*″, and only leaves it when an incline K, has opened the cam K′, K′. L, cross piece, having hooks, which raise the plates when the traveller or car has brought them facing the position they are to occupy on the endless chains. L′, levers and axes, serving to work the cross beam L, and set in motion by the cam H″, H″, H″. M, moveable pieces, carrying the wheels and pinions, and making the wheels *q*, communicate with the two other wheels *q*′, *q*′: these two pieces are made moveable, so that the number of buttons placed on each plate may be varied. N, pressing plate. N′, cranks of the plate N. O, india-rubber washers, for the passage of the air from the cavity V′, to the moulds *b*. O′, eccentric, lifting the valves of the prism. P, double kneed shaft, bearing the wheels *q*, *q*′. R, axis and pinions, working the machine. S, lever arm, on a pivot round the axis X, and receiving its motion from the excentric *y*, and *y*″.

Figs. 1, 2, 3, 4, 5, 6, Sheets 1, to 6, represent the machine for the manufacture of buttons singly. H, collar, in the circumference of which are a certain number of cavities, each containing a mould moving in the direction of the radius: round this collar the operations for the striking are simultaneously made; at each turn of the principal shaft E, the collar H, advances one division by the rack cut in it, and which sets in motion the eccentrics and the counter pieces *h*′, *h*. When one of the cavities is facing the upper mould, adapted to a vertical groove, setting in motion a crank D, and the lever C, this upper mould descends and compresses the matter; at the same time the cavity is furnished with paste or matter in passing under the sieve in which the agitator works; and the button, after having been struck at the upper part of the collar H, and transferred in consequence of the rotary motion of the collar to the lower part, is deposited on a refractory earthenware slab, which is displaced at each operation, so as to make room for the following button. At the moment that the pressure is effected, the air which the piston *j*, of the air pump J, has compressed during the remainder of the operation is thrown into the interior of the stamp by a detent *j*″, similar to the detent of an air gun, and the matter sticking to the holes is expelled. To avoid the machine becoming oxidated, the air is dried by some of the means in use. The different motions that the plate makes to receive the buttons are effected by a crank K, acting on a double ratchet, which gives a to and fro motion to the plate in the direction of its length, and of which the shaft at each of the extremities of the run of the machine acts by means of a reverse piece, causing the plate to advance. In the side direction, of the thickness of a button. Each time the plate has accomplished its longitudinal course, and when the last row is completed drawn by the first ratchet acts on the driving shaft to detach it from the machine by means of an unconnecting hook. The mode of charging the machine with the paste can be varied thus :—It may be made on cups, each receiving a single button, and arranged on an endless band, made to pass successively at the point where the button falls; and the charging, instead of being over the moulds, may be made at another point near the machine, by the aid of a lever bringing the matter necessary for each supply. The upper and lower part of the apparatus cannot be displaced laterally, but only raised & separated vertically from a sufficient quantity for the plates receiving the products, and the small cars bringing the material to pass between the two moulds, either at the same time or successively. In this case the machinery, instead of pulling the upper and lower portions of the tool, displaces on one side the plates to withdraw them from pressure, and on the other the load or charge to convey it under the sieve supplying the small cars. When the matter by its cohesion is slow in falling, a pneumatic pump is placed under the holes of the lower mould, and, when the upper mould is raised, causes a current of air, whose force throws out the particles of matter which might stick to the holes of the mould. A small brush or stick may replace this pump, as with them the holes may be cleared.

Description of Sheets 1, 2, 3, 4, 5, & 6.

Fig. 1, elevation of the machine seen from behind.
„ 2, left side elevation of the same.
„ 3, right side elevation of the same.
„ 4, longitudinal section, through A, B, of Figs. 2 & 3.
„ 5, horizontal projection of the machine.
„ 6, lateral section of the machiny through C, D, Fig. 1.

A, framework; B, vertical groove; C, lever; D, dynamometrical crank, measuring and equalizing the pressure given to the products; *b*, ; *b′*, wedge, enabling the distance between the moulds to be varied; E, crank shaft, having a cam; F, toothed wheel; G, pinion, pulley, & fly wheel; H, ring or circle bearing the moulds; *h*, ratchet,

1853

causing the ring or circle to advance one division; h', crank & return motion of the crank of the ratchet; I, shaft, round which the circle H, rotates; i, beam throwing off the buttons when struck; i', crank connecting the beam i, with the lever C; J, air pump; j, piston of air pump; j', passage and course of the air; j'', air valve; K, crank for the horizontal displacement of the plates; R, ratchet, with a detent acting singly; k, ratchet, for the longitudinal motion; L, ratchet & bolt catch for the lateral or side motion of the plates; l, latchet, rising & falling, acting on bolt of ratchet L; l', screw & nut, making the lower framework advance laterally; M, sieve, into which the paste is placed; *m*, screw agitator, forcing the matter to fall & fill the cavities in the mould; N, stopping lever; O, apparatus to dry the air; *o*, air entrance; P, pump, aspirant the air by means of the pipes T, and sending it into the pump J, by means of the pipes T'; U, hygrometer.

This process may be applied to screw presses worked by hand, either for a single button, or for several at a time. The tool has a double working collar, Figs. 1, 2, 3, & 4, as in the multiplicate machine. The force applied to the fly wheel forces the paste to pass from the lower plate into the upper. In consequence of the difference of power of the springs, & during the pressure, the pedal opens the valve, giving entrance to a portion of air compressed in a reservoir. The lever being raised, a pressure on the second pedal frees the button that has been struck, and raises the upper plate by means of a backward motion, connecting the pedal with it. Figs. 5, & 6, represent small hollow [*the word* shovel *is here inserted in pencil*], having a lower *groove.* Above is a platform, receiving the basin or cup, into which the button falls. One stroke of the lever moulds the button. The friction pulleys L, L', are an improvement in screw presses, and allows to raise the circle M, in such manner × as to avoid the use of muscular force. The pedal N, sets in motion the circle.

Sheet , Fig. 1, longitudinal section of the machine; Fig. 2, front view of the machine, with section through A, B, Fig. 1; Fig. 3, horizontal projection of the machine; Fig. 4, section through *c, d,* Figs. 1, & 2. A, stamping-out tool; A^1, wooden frame for the same; B, screw, giving pressure; C, slides; D, upper part of the tool;

E, lower part of tool; *d*, upper mould; F, point at which the air arrives; G, pedal & lever working the valve; H, columns or pillars working on the upper plate D, when the fly wheel is up; J, pedals & lever working the pillar H; K, T shaped pieces, bearing the pulleys L, L′; M, fly wheel; N, pedals & levers working pulley L; N′, pedal & lever working pulley L′; O, elastic tompion, to regulate the course of the fly wheel.

Pulverising.—For pulverising & sifting the matter, a grooved cylinder, with interior circular grooves, is used. In each of the grooves are one or several balls, which pass over the products that are introduced; the cylinder is divided into separate chambers by partitions in the shape of sieves. These sieves are placed so as to radiate and have their plane in the direction of that of the axis; they are connected together by inclined planes, which send the products passing through a sieve into a next partition. A current of air may be used to expel the pulverised products from one partition into another. A funnel may be used to introduce the pulverised matter. Sheet Fig. 1, longitudinal section by the axis of rotation; Fig. 2, horizontal projection of the pulveriser; Fig. 3, side section through *a*, *b*. A, supports, made fast to the ground framework B; C, cylinder; D, balls, crushing the matter; E, sieve, with decreasing openings; F, pulleys & gearing working the apparatus; G, pipe connecting the cylinder to the aspirating chamber; H, chamber, with partitions, freeing the air from dust; I, aspirator.

Mixing Apparatus.—The cylinder A, has but one pivot, B; it works on a false bearing. The closing part *c*, is central, & replaces the second pivot. The various stages of the operation may be seen when the products are not volatile. The frame that bears the extremities of the axis of the apparatus is on two pivots, perpendicular to those of the cylinder. The gearing E, may be set in motion, & the whole of the apparatus, notwithstanding this double perpendicular joint, giving the facility of inclining or emptying the cylinder while it is turning, and with a blade having the shape of the interior of the cylinder, the whole matter may be cleared out. The axis of the cylinder is perforated to allow the introduction of the liquids or gases.

1853

Baking.—The buttons manufactured by this process being a kind of enamel, may be fired in ovens used for firing enamel; but there is an advantage to use, in lieu of the ordinary ovens, the improved oven represented in Sheet of the drawings. Fig. 1, vertical section of circular oven; Fig. 2, plan & horizontal sections of the circular oven, Fig. 1; Fig. 3, vertical section of an oven having and circulation of the products; Fig. 4, plan & sections of Fig. 3. A, Figs. 1, & 2, grate; B, flame channel; C, passage for the products; D, circular oven, in which the products are circulated; E, plates bearing the products; F, car of masonry; G, cast-iron plates supporting car; H, rails in connection with the car; I, rollers, mounted upon shafts receiving their motion from the exterior; J, doors; K, door, with register or vertical slide; L, L, Figs. 3, & 4, ; M, space for circulation of flame; N, passage for the escape of products of combustion; O, circular vault, in which the products circulate; P, stands, on which the products are placed; Q, car & accessories; R, door, for introducing & taking out the products.

Moderating Oven.—Fig. 4, Sheet , represents an oven heated at its upper extremity with the waste heat of one of the before-described ovens, or by a grate, and cooled at its lower extremity by a current of air C, D.

Firing by Gas.—The direct action of the flame of the combustible gas may be used instead of the heat of burning coal; pure or carburetted hydrogen, & air or oxygen, are received separately in a small gas meter A, which regulates the pressure, and provides a certain quantity of the two gases; quantities which may be diminished or increased by the help of the cocks B, & pass separately into a small gas-meter C, of the capacity of three or four pints, containing an agitator D. The mixture is effected in this gas-meter. The tube in connexion with the firing tubes is furnished with a metallic cloth or wire E, as this mixture is explosive. The small gas-meter may be dispensed with, as the gases may be easily mixed in the tube containing the metallic cloth: Figs. 11, and 12, Sheet . The orifice from which the gas escapes is composed of small capillary tubes F, Fig. 7, Sheet , presenting a surface rather larger than the surface of the buttons to be fired. It turns constantly on a horizontal plate G, distributing the heat so as to gradually fire the button. The buttons are exposed to a series of small gas jets or burners H, or to two heated passages I, to raise or decrease the temperature of the button.

Moulding by Gravitation.—The apparatus is composed of a vessel of refractory earthenware, having nearly the shape of a mortar, and placed in a furnace B, in such manner as to raise the temperature of the vessel to a suitable degree. The lower part of the mortar has a small circular opening O, and rests on a basis C, pierced with a hole corresponding to that of the vessel, which has an earthenware or cast-iron pipe passing through the masonry or the ash-pan of the furnace. The opening in the bottom of the mortar is closed by an iron rod covered with refractory earthenware, and its conical extremity is partly introduced in the hole O, and thus acts as a valve: Fig. 13, Sheet . The matter is introduced into the mortar, the valve closed, and when the whole matter is in a state of fusion, and that the vitrified matter is suitably purified, that is to say, when it has no more bubbles, the rod is raised, and it flows through an aperture E; the matter falls, at a red heat, on a metallic plate F, having a small slit, into which is adapted a bar Q; this bar has its extremity in the vitrified matter. The apparatus is arranged in such manner that the drops may always fall exactly at the same place. The valve being suitably worked, buttons of various sizes may thus be obtained.

Moulding by Dies.—Instead of receiving the vitrified matter in the manner described, it may be received in the hollow die, having the form of the under part of the button; and in the soft matter four small steel rods are made to enter, which form the holes; an upper die completes the shape of the button.

Paste or Matter.—Till now the jalspath of oxide of iron, employed pure, or mixed with a variable quantity of kaolina, with some hundredth parts of lime of potash or of soda, forming the basis of different qualities of buttons. This substance, through the absence of an earthy oxide, or of metal, and by the insufficient quantity of alkali to make it a fusible compound at a moderate temperature, requires, in consequence of its nature, a considerable quantity of caloric. To remedy this, the jalspath,

1853

silicate of alumina and of potash, may be replaced by one or several simple silicates or compounds artificially produced, and to which hardness, tenacity, fusibility, & various shades may be given by the addition of natural silicates of salts of oxides, or other suitable substances. The jalspath, kaoline, and other natural silicates, may be used by introducing into them a suitable quantity of alkaline bases, earthy or metallic, which thus produce silicates that are easily melted & made into a kind of glass or crystal. The artificial silicates, simple or compound, always form a vitrified matter, but the application of these substances, pure or mixed, have not yet been employed in the mechanical manufacture of perforated buttons. All vitrified matter may thus be turned to account for the manufacture of buttons.

To color & harden the buttons, oxides, metals, acids, chlorides, and hyodurates, sulphuretes, &c. may be employed. To unvitrify the matter recourse must be had to substances that deprive the matter of the alkali; for instance, silex in fine powder, kaoline, &c. To obtain this result, the buttons may be heated in a cement by aid of the Reaumur machine for porcelaine; but I prefer to mix directly the unvitrified matter with a silicate powder. If the contrary result be desired, potash, soda, oxide, lead, zinc, bismuth, is added.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Constant Jouffroy Duméry, in the Great Seal Patent Office, on the 14th October 1853.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Constant Jouffroy Duméry, of Paris, in the Empire of France, and of 16, Castle Street, Holborn, in the County of Middlesex, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fourteenth day of April, in the year of our Lord One thousand eight hundred and fifty-three, in the sixteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Constant Jouffroy Duméry, Her special licence that I, the said Constant Jouffroy Duméry, my executors, administrators, and assigns, or such others as I, the said Constant Jouffroy Duméry, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE MANUFACTURE OF PASTE AND ENAMEL BUTTONS," upon the condition (amongst others) that I, the said Constant Jouffroy Duméry, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Constant Jouffroy Duméry, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, that is to say:

My invention consists, firstly, of improvements in the product, and, secondly, in the mode of manufacturing buttons. These means of manufacturing comprise a new arrangement of machinery, improvements in preparing apparatus for the pulverizing and mixing, new means of baking by gas, and moveable furnaces; an application for moulding the paste while heated, and a new composition of paste.

OF THE PRODUCT.

The improvement consists of rounding the holes on each side of paste and enamel buttons, as in Figures 8, 9, Sheet 7, instead of as they are generally made, with sharp edges (see Fig. 9 bis, Sheet 1). These sharp edges cut the thread, and render the buttons objectionable. The purpose of improving this product is to extend and render its application general by doing away with the only serious inconvenience which it now presents.

1853

OF THE MACHINES.

The machines are of two kinds: the one for making many buttons at a time, the other for making but one at each pressure. In all machines which make paste buttons, the operations of charging, striking, piercing, and withdrawing, are made successively at the same point, and require a considerable time to perform the whole series of operations necessary for making buttons. To compensate for this delay the number of moulds is increased; and another difficulty occurs, which consists in the great expense of apparatus, and the keeping it in repair, and which, besides, does not afford all the advantages which could be expected, in consequence of the numerous rejections which are occasioned by the irregularity of pressure resulting from the too great extent of the striking, and the inevitable inequality of the charging.

In addition to these inconveniences, the necessity of employing piercers for piercing buttons requires such a precision, that it entails a considerable expense, and almost renders the difficulties more complicated by arranging the edges of the punches in such a manner as to round the edges of the holes of the buttons. These difficulties are surmounted by suppressing all kinds of piercers for the piercing of the holes, and by dividing the operations to effect the simultaneous action of several of them, as I shall demonstrate by describing the two machines which I have invented, and which produce, the one an indeterminate number of buttons, the other but one at a time. I suppose the lower half B, of the instrument A, B. (Fig. 1, and 2, Sheets 1, 2, 3, & 5,) brought under a distributor C, placed at the lower part of a sieve D, containing the pulverable substances, and furnished inside with a circular agitator E, and with vertical agitators F, having simultaneously a rectilinear and rotary motion. If the circular agitator works in a manner sufficiently continuous to prevent the formation of the cavities which the plasticity of the matter might occasion, each of the agitators, by its eccentric movement, will conduct the material opposite a hole made in the slide C, and corresponding to the lower parts of the moulds. The holes of the slide C, will be filled with material, not compressed, but merely uniformly spread; and when the slide will have passed the space C'', C''', the holes *d*, will become opposite the holes of the same size made in the plates surrounding the slide. A light pressure exercised upon the clearing comb G, will force the matter from the slide. This will be received by the lower part *b*, *b*, of the mould, and it will only then be necessary to carry this half mould towards the point of the machine where the pressure operates; that is to say, under the lower part, which corresponds to it. The distribution of the matter could also be made by a circular distributor, presenting its lower part under the sieve, and, after a half turn, depositing the matter in the lower part of the instrument.

If, while the lower part *b*, *b*, is furnished with paste, the upper part *a*, *a*, containing the button previously struck, has been carried to the opposite side, and there it has encountered the means of pressure H, which makes the buttons fall upon a moveable plate I, in consequence of a slight movement given to the counter collar *a*, *a*, of the upper stamp, we shall have an idea of all the operations of the machine, except the striking and piercing, which will be described. The striking is performed, like all operations of this nature, by exercising a pressure by one of the means afforded by the lever, the screw, &c. &c., when the two halves of the moulds are fitted to one another; also, it is not by the means which afford the compression that my process is distinguished. It differs from those actually in use, first, by the horizontal division of the ring or collar *a*, *a*, *b*, *b*, of the mould. One of the two halves of this collar remains constantly around the lower part, while the other half does not cease from accompanying the upper part; and it is precisely this division of the ring or collar of the mould which allows the functions of charging and expelling to be simultaneously performed. The charging, on the one hand, for which all the elements are prepared in the distributor during the operation of the stamping, and, on the other hand, the reception, the place of which is arranged, likewise, during the striking by a rectilinear horizontal movement given to the receding plate I, so that it may leave a space necessary for a fresh row of buttons.

The second point by which my stamping differs from the present stamping consists in the elasticity given to each of the stamps by the

1853

levers B′, giving them the property of rendering the pressure uniform; so that if some of them receive an unequal quantity of material,—that is to say, if, notwithstanding the precautions taken for the distribution, there are inequalities in the charging,—the pressure exercised upon the button would be always uniform, whatever be its hickness. In this way I diminish the considerable number of rejections which the multiple stamping occasions, and the different parts of the mechanism are not subject to wear and tear more at one time than other, whatever may be the irregularity of the charge.

The third part, by which my stamping is superior to that effected by screws, consists in the equality of its operations, obtained by rigidity and by the gearing at the extremities of the compressor N′, N′, and which it is impossible to obtain with a pressure exercised only at a central point, which central point is unable to bear the oscillating movements which are produced by the irregularities of charging, and which tend to blunt the edges of the moulds and stamps, to increase the wear, and render very difficult and expensive the precision of working which this kind of manufacture requires. The piercing, which is the object of a special adaptation of work, requires piercers and a particular gearing, which also renders necessary a great precision in the arrangement of the holes, and in this machine, worked instantaneously, at the moment of stamping, as follows:—

The upper part of the apparatus A, A, although not being able to be fixed to the compresser N, is, nevertheless, sufficiently well adjusted in all the parts where the metals come in contact, and well armed at the different joints with little washers of vulcanised caoutchouc K, K, so that at the moment when the pressure is exercised, although the caoutchouc is only local, the joint which results from its juxta-position or compression prevents all passage of the air.

The stamps are pierced completely through in the points which form the holes in the buttons; these holes, or one only, uniformly pass the plates which bear the stamps; and it is in a cavity made round this hole that the india-rubber washer just mentioned is fixed. Similar corresponding holes are made in a hollow prism V^1, situated above the compressor. Each extremity of this prism is furnished with a box, with a valve bearing a tube, to which a pipe, jointed or elastic, is fitted, having the other extremity fixed to the recipient, in which a special machine compresses the air to a sufficiently great pressure to establish a current sufficient to effect a proper clearing of the holes. The air confined in the recipient and in the pipe is stopped at the entrance of the prism by the valve upon which it passes. It is only at the moment when the operation of the pressure of the button mould is at its maximum, and the air being displaced by the lower eccentrics O′, the air rushes in each of the holes with the rapidity with which it rushes from an air gun, and produces a perfect perforation of the buttons, without the slightest alteration of the edges of the mould. This operation of piercing by the air might be also effected by having a hollow compressor, in which one or more pistons would compress the air necessary for each blowing. The current of air may even be in an opposite direction; that is to say, from downwards upwards. Perhaps, even the simple depression produced by the vacuum established on one side, where the clearing is desired to be made, would suffice. It is not, however, in the manner of using the air that my Invention consists, but in the application of the air to the clearing the holes of the buttons.

Description of Sheets 1, and 2.

Figure 1, front elevation of the machine.

„ 2, vertical section in the line A, B. This Figure shows the curves of the different eccentrics which effect all the movements.

„ 3, section through C, D, of the Figure 2. This Figure shows the details of the apparatus.

„ 4, horizontal projection of the machine, supposing half of the sieve D, to be raised to show the instrument.

„ 5, horizontal section; the half through E, F, that is to say, supposing the upper part of the instrument raised, and the other half through G, H, that is to say, through the axis of the two-cranked axle.

In all the Figures, the same letters indicate the same parts.

1853

A, A, upper part of the instrument, to which is attached the plate bearing the stamps.

B, B, lower part of the instrument, into which the counter stamps enter.

B^1, dynamometrical levers, upon the extremity of which the pressure is made.

a, *a*, upper half of the jointed collar.

a', upper moulds.

b, lower moulds.

b, *b*, lower half of the jointed collar.

C, distributing slide, worked by the parts C', which only act upon the slide in the direction *b*, *c*, and not back from *c*, to *b*. There are springs, which make the slide return to its first position. D, sieve, in which the powder is poured. E, circular agitator. F, small agitators. F', pinion upon the axis of the agitator. F'', vertical toothed rack, working the circular agitator. G, cross bar, kept in place by the rod *g*. H, compressing and cross bar, for the deposit of the buttons upon the plates. H', H', lever, jointed to the point H'', and receiving its motion from the cam h'', h'', h''. I, plates, for placing the buttons in the oven. *i*, endless chain, bearing the plates. I', nut, having a rotary movement by the arrangement of gearing I'', the levers I''', and the cams V, V, V. J, car, bearing the plates upon which the buttons are placed. J', J', cranks and levers, working the car J, and moved by the cams.

J', J', J'. These cams only act once in eight revolutions; in the other revolutions, the roller follows the circular groove j'', j'', j'', and only leaves it when an inclined plane K, causes the cam K', K', to work.

L, cross bar, bearing the forks which raise the plates when the car has brought them opposite the position which they should occupy on the endless chain. L', levers and axles to work the cross bar L, and acted upon by the cam h'', h'', h''. M, moveable pieces, bearing the wheels and pinions, making the wheels *q*, communicate with the two other wheels q'. These two pieces are moveable, so as to be able to vary the number of buttons placed upon each plate. N, compressor, compressing the buttons. N', cranks of the compressor N. O, caoutchouc washer, for the passage of the air from the cavity V', to the moulds *b*. O, eccentric, raising the valves of the prism. P, axle, with double crank, bearing the wheels *q*, and *q*. Q, toothed wheels, forming grooved eccentrics, working the agitators, the raising up of the upper part of the machine, the clearing, the deposit of the buttons upon the plates, the car carrying the plates and the valves for the piercing of the buttons by the air. Q′, toothed wheels, forming grooved eccentrics, working the chains for the advance of the plates, the cross bar raising the plates, the inclined plane of the cam K′. R, axles and pinions working the machine. S, arm of the lever, revolving around the axis X, and receiving its motion from the grooved eccentric Y, and from the other eccentric at the upper part of the instrument A, A, by means of the arrangement for return motion Y.

The machine for a single button, and which is represented in the Figures 1, 2, 3, 4, 5, and 6, Sheets 2, and 3, consists of a ring or collar H, in the circumference of which are made a certain number of holes. In each of these cavities a mould is placed, able to move in the direction of the radius. It is around this ring that the different operations relative to the striking occur simultaneously. Thus, at each of the revolutions of the principal shaft E, the ring H, advances one division by the effect of the cogged teeth formed in its circumference, and which work, in the requisite manner, the whole arrangement of eccentric crank and return movement *h*, and *h*′. When one of the cavities faces the upper mould fixed to a vertical slide, which are put in movement by the crank D, and the lever C, this upper mould descends and compresses the material; at the same time the preceding cavity is furnished with the paste as it pastes in the sieve in which the agitator works; and the button, after having been struck on the upper part of the ring H, and having been, in consequence of the rotation of this ring, carried to the lower part, is deposited on a plate of refractory earth, which is freed of a sufficient quantity in the required direction in order to make room for the buttons about to be manufactured. At the moment when the pressure is effected, the air which the piston *j*, of the air pump J, has compressed during the cessation of the operation, is injected into the interior of the stamp by means of a spring J″, similar to the spring of an air gun, and the matter which stops up the holes becomes expelled. In order that

1853

the mechanism may not oxydize by the moisture of the atmosphere, we take care to dry the air beforehand, by the ordinary means. The different evolutions which the plate makes to receive the buttons are effected in a satisfactory mode by a single axle K, acting on a double ratchet; the object of which is to make the plate advance and return longitudinally, and the axle of which acts at each of its extremities by means of a return motion upon a second double toothed piece, which causes the plate to advance in the lateral direction of the thickness of a button at each time this plate has terminated its longitudinal course. And when the last row is complete, a click, worked by the first tooth, acts upon the moving axle, to detach it from the machine by aid of ungearing apparatus.

The manner of charging with paste, and the reception thereof, may vary in this way, that in the single machine which we have just described, the reception of the material can take place in the cupels, each receiving a single button arranged upon an endless sheet, which causes them to pass one after another under the point where the button is left; and the charging, instead of being placed above the moulds, can be placed in another situation by means of the arms of the lever bearing the material, charge by charge, as in machines for coining money, to the place where the button is to be stamped. Likewise, in the multiple machine, the upper and lower parts of the apparatus need not be displaced laterally, but only be raised and separated vertically a sufficient space, so that the plates receiving the products, and the little cases bearing the material, may pass between the two moulds, either at the same time, or one after the other. In this case, the mechanism, in place of working the upper and lower parts of the apparatus, separates the plates on one side to remove them from the pressure; and, on the other side, the charging, to carry it under the sieve which supplies the cases. When the primary matter is of a nature to allow it, the blowing is suppressed, and one only of the two moulds is used.

Figure 7, Sheet 1, represents the matter which occupied the place of the holes before the compression falls to the lower parts, assisted, as it is, by the form which is given to the edges of the moulds to round the holes of the products, and by the conical form of the lower holes. When the matter, by its cohesion, is delayed from descending, the holes of the lower mould are put in communication with an air pump, which, directly after the upper mould is raised, effects a rush of air, the rapidity of which bears away the particles which may be attached to the sides of the holes of the mould. If the machine to which I apply the full stamps renders the application of a pneumatic apparatus difficult, a small brush or stick is introduced into the holes of the lower mould, to divide the dust, and cause it to descend by a circular lateral or vertical agitation. My purpose, either with the aid of the air, or with the upper mould, with or without the help of the vacuum, is to suppress all mechanical piercing of the holes, and at the same time, as has been shown already, to obtain results infinitely superior to those at present obtained, by giving the buttons holes with rounded edges.

DESCRIPTION OF SHEETS 2 AND 3.

Figure 1, front elevation of the machine.

Figure 2, lateral elevation, left side.

Figure 3, lateral elevation, right side.

Figure 4, longitudinal section through *a*, *b*, of Figures 2, and 3.

Figure 5, horizontal projection of the machine.

Figure 6, lateral section of the machine through *c*, *d*, of Figure 1.

A, framework; B, vertical slide; C, lever directing the slide; D, dynamometrical crank, rendering the pressure given to the products uniform; *b*, connecting mail; b^1, wedge, for varying separation of the moulds; E, axle, with handle and cam; F, toothed wheel; G, pinion, pulley, and driving wheel; H, collar bearing the moulds; *h*, ratchet, making the collar advance one division; h', crank and return movement of the tooth of the ratchet; I, axle, round which the collar bearing the moulds turns; *i*, bar, for removal of stamped buttons; i^1, crank, connecting the cross bar *i*, to the lever *c*; J, air pump; *j*, piston of the air pump; j^1, direction of the air; j'', air stop; K, crank of separation of the plates horizontally; *k*, ratchet with double click; *k*, toothed bar for the longitudinal movement; L, ratchet catch for the lateral movement of the plates; *l*, oscillating piece, which

1853

moves the stop of the ratchet; *l′*, screw and its nut, causing the lower framework to advance laterally; M, sieve, in which the material is placed; *m*, helical agitator, forcing the material to descend and penetrate into the cavities of the mould; N, ungearing rod, communicating with the mechanical gearing, for stopping and putting in motion the apparatus; O, apparatus for drying the air; *o*, entry for the air; P, pump, drawing air by means of pipes T, and sending it in the pump J, by means of pipes T′; T, suction pipes; T′, compressing pipes; U, hygrometers.

I will now describe the means that are employed in my process relative to the stamping of buttons by the press, either for a single button, or many at the same time. The instrument has a double working collar, Figures 1, 2, 3, and 4, Sheet 5, like in the multiple machine, the compression exercised by the driving wheel forces the paste from the lower plate into the upper one, in consequence of the difference of power of the springs, as has been explained previously; and during the exercise of the compression a working of the pedal opens the valve, which gives outlet to a small portion of air compressed beforehand in a reservoir serving one or many machines. When the balance is raised up, a second pedal, which disengages the button and causes the upper plate to reascend by means of a return motion, which connects the pedal with the upper plate.

Here the advantage of my double collar for striking, which permits me, even in working by hand, to affect simultaneously the charging and the withdrawal of the button, is to be particularly noted. For this purpose I have contrived for this double work a small ladle, Figures 5, and 6, Sheet 6, with a lower slide like those in use, but surmounted by a platform holding the vessel in which the button falls, so that at one and the same movement of the balance beam the button is struck, replaced upon the upper part, and deposited in the vessel, while the charging is effected. A no less important improvement that I have made in screw presses employed in the manufacture of buttons consist in the application to these instruments of friction pulleys L, L′, for lowering and raising the crown M, of the press, so as to save the workman from too great exertion. A simple movement of the pedal N, lowers the crown; and, if the blow of the balance beam is not sufficiently powerful and sudden to mak it return to its starting point, a like movement upon the pedal N′, is sufficient to bring it to its first position.

DESCRIPTION OF SHEET 5.

Figure 1, longitudinal elevation of the machine.
„ 2, front view, with part in section through *a*, *b*, of Figure 1.
„ 3, horizontal projection of the machine.
„ 4, horizontal section through *c*, *d*, of Figures 1, and 2.

A, shears; A′, framework for them; B, screw, for the pressure; C, small slides; D, upper part of the instrument; E, lower part; *d*, upper mould; *e*, lower mould; F, entrance of the air from any recipient whatever; G, pedal and lever, working the valve for the blowing; H, rods, working the upper plate D, when the driving wheel is above, so as to make the button fall; J, pedals and levers, working the rods H; K, pieces of a T shape, bearing the two pulleys L, and L′, turning in a contrary way, working the driving wheel M; M, driving wheel, working the screw; N, pedals and levers, working the pulley L; this pulley turns the driving wheel to effect the pressure; N′, pedals and levers, working the pulley L′; this pulley turns the driving wheel to raise the screw; O, elastic pad, to regulate the course of the driving wheel.

3. PREPARING APPARATI.

(PULVERIZING.)

The grinding and sifting having a very great influence in the manufacture of paste buttons, I have effected a mechanical pulverizing in a mortar turning on an axis, and with an eccentric pestle, whereby all the materials to be ground must be inevitably brought under the pestle.

For grinding and sifting I have formed a cylinder, with interior circular grooves, receiving in each of these grooves one or more bullets, which, as in all apparati of this kind, pass over the materials which are introduced as it turns; only I have taken care, and here it is that my Invention is embodied, to divide my cylinder into many separate chambers by

1853

divisions in form of sieves or network, in order that the materials may only pass into the next chamber when they have received in the preceding chamber the desired degree of work. These sieves are placed in the most advantageous manner, that is to say, radiating and having their plane nearly in the plane of the axis. They are joined to one another by inclined planes at the left side, which force the material which has crossed a sieve, to descend into the next case. In order that the material may always go in the direction of the work, I have arranged the whole apparatus so as to give it an incline at will. Thus the passage of the air from one chamber to another is accelerated or diminished, and consequently the production of the whole apparatus, by clearing away each chamber of the products which may be made use of in the next chamber. When I divide materials which require a perfect tenuity, I do not confine myself to this work of mechanical sifting; the pulverized material is forced by a current of air to pass into a second chamber, divided by a certain number of partitions, where a deposit occurs by reason of the weight of the particles. To avoid giving to the orifice for the introduction of the material a too great dimension, which would render the rush of the air less strong, the materials to be pulverized are introduced by a funnel immersed in a semi-circular trough, in which it raises the materials as they are dropped.

DESCRIPTION OF SHEET 6.

Figure 1, longitudinal section by the axis of rotation.
„ 2, horizontal projection of the pulverizer.
„ 3, lateral section through *a*, *b*, Figure 2.

A, foundation on the ground, supporting the framework B; B, framework, supporting the cylinder; C, cylinder; D, bullets, bruising the material; E, sieve, with crossed openings, to regulate the pulverizing of each case; F, pulleys and gearings, moving the apparatus; G, pipe, joining the cylinder to the air chamber; H, chamber, with divisions for disengaging the air from the powder, and for leaving the latter at the lower part; I, air pump.

MIXING APPARATUS.

In general, to mix chemical substances together, a revolving drum or ellipse is used, into which the substances are introduced with a certain quantity of balls, which perform the operation satisfactorily, but with great expense. The action of these apparati is difficult, troublesome, and uncertain. The elliptical box A, has only one pivot B; it works eccentrically; the closing C, is central, that is to say, that it occupies the place of the second pivot (wanting), and allows the operator to follow the course of the operation when the products are not volatile. Independently of this facility of open operation, I have desired that the emptying of the apparatus could be made without the trouble and the time which the raising of the balls and the material require, and without the loss of material which the application of the lateral sifting entails. The framework which bears the supports of the axis of the mixing apparatus is mounted upon two pivots perpendicular to those of the ellipse, and the gearing E, arranged so that the whole apparatus can be moved notwithstanding this double perpendicular articulation, which allows of slanting and of even reversing the whole ellipse, whilst it is turning, so as to empty successively, or all at once, the balls and the material which it contains, or in such a way that, with a sheet having the form of the sides of the ellipse, the material will be caused to come out only as it covers the sides of the vessel. The elliptical axis is pierced in places, to introduce at will the liquids, or the necessary gases for the operation; to permit those to escape which result from the mixing. Figures 4, 5, & 6, Sheet 6.

4. OF THE BAKING.

OVENS.

The buttons being simply enamel, ovens for enamel are to be used; but these small ovens have great inconveniences, such as the want of uniformity in baking, and the unequal distribution of the heat. The returning of the plates by work of hand entails a considerable loss of time. My baking apparatus consists of a long circular gutter inversed,

1853

that is to say, presenting its convex part upwards, and its concave downwards. This concave part serves as an arch to a kind of circular gutter, occupied by a car of the same form and dimensions, mounted upon a railway, and having a continual rotary movement. This car supports a construction of brickwork, solid or hollow, or of materials which may be good conductors of heat, and terminates near the arch by a surface furnished with small projections for supporting the plates bearing the buttons to be baked, which circulate under the arch while the flame surrounds it, held and guided as it is by a covering in masonry, fixed at a distance from the arch which covers the materials. Thus the whole surface of the plate bearing the products is exposed to an uniform temperature in all its parts; the action of the heat is graduated during the whole operation, because the product is caused to be moved towards the fire, that is to say, in an opposite direction to the flame. Any return of the plate is not necessary during the operation, and all the hand-work is confined to a simple placing in and withdrawing from the oven. The operation is accelerated or rendered slower in two ways; by the draft, if it is the intensity of the heat which is to be varied, and by the acceleration, or the contrary, of the speed of the car, if it is desired to change the duration of the baking.

If it should be necessary that the flame should circulate equally under the plates, that is to say, in the moveable part, either by establishing a fire in the moveable part itself, and feeding from below, or even by constructing the furnace in the fixed part, by making holes lateral to the sides of the moveable part, and by effecting a very rapid draft on the side diametrically opposite, so as to force the product of combustion to be kept in the moveable channel, in consequence of an atmospheric pressure established in the circular channel. This circulation of the products in the fire may be applied to ordinary porcelain furnaces; and in this case the fire-places being, as usual, outside, the flame may rise, then descend, and again rise, in the central chimney, after having surrounded a circular case in which the partition works, with shelves upon which the plates with the buttons rest, as is shown in Figures 1, 2, 3, and 4, Sheet 8. The moving of the moveable piece may be effected mechanically or by hand, and in a continuous or intermittent manner; continuous, by placing in and withdrawing the plate while the products pass; intermittent, that is to say, suitable to the charging and exit, and determined by them, or by the degree of the baking. The channel and railway are to avoid the elevation in the temperature of the different parts of the circulating mechanism. To avoid the direct radition of the lower cold portions, it is necessary to break the straight line by making the materials of the moveable part enter the fixed part; and this can be easily done. What I have done with regard to the furnace with a circular channel may also be applied to the furnace with rectilinear channel with moveable divisions. In this case, for saving of trouble and economy of heat, two furnaces should be joined, working in different directions, in such a manner that the discharging of the one should take place on the side where the other discharges.

Regarding the transmission of caloric in this oven, the whole surface of the products to be baked receives the whole heat, the complete intensity of the flame is distributed, and the whole arch is attacked by the flame. Whilst in the muffled furnaces, three of the little sides only are acted upon or visited by it; and this is not by lateral propagation, by communication from one place to another, as the heat is transmitted and arrives at the centre, slowly, expensively, unequally, and irregularly.

Regarding the opposition to the baking, the elevation of temperature which this species of oven can communicate to the pieces which are submitted to it, allows of enriching the manufacture of the buttons with a mass of substances more refractory, more difficult to bake and vitrify, but at the same time more solid and less friable, than the tender and fusible substances that are chosen and worked together, to bring them within the power of fusion by a muffled furnace.

Regarding the success of the baking, I can at will either attack the materials with an intense heat, or make them undergo a graduated temperature, according to the requirements of the products, a result impossible to be obtained by the muffled furnaces. Likewise I can take out the plates, and make them pass slowly and in succession through a series of temperatures, crossing them incessantly, if their

1853

delicate nature renders it necessary, without being obliged, as with the muffled furnaces, to expose them quickly to the cold air.

Regarding the rapidity of the baking, I can keep up, on the whole surface of the plate charged with buttons, an uniform temperature, whilst in the muffled furnaces the anterior part which is near the entrance is infinitely lower than that of the bottom.

Regarding the simplicity and rapidity of work, in consequence of the uniformity of temperature, I am able to bake in one single time, whilst by the muffled furnace it is necessary to turn the product by the aid of a suitable instrument, and without which turning there would only be one portion of the surface completely baked.

DESCRIPTION OF SHEET 8.

Figure 1, vertical section of a circular furnace, with a contrary current.

Figure 2, plan and horizontal section, at different heights, of the circular furnace, represented Figure 1.

Figure 3, vertical section of a furnace with fire places and circulation of the products.

Figure 4, plan and sections, at different heights, of the furnace Figure 3.

Note.—In the Figures 1, and 2, the same letters indicate the same parts, the same as Fig. 3, and 4.

A, (Figures 1, and 2,) furnace; B, channel for circulation of the flame; C, channel for outlet of the products; D, circulating oven or channel, in which the products circulate; E, plates bearing the products; F, car in masonry; G, plate of cast iron, supporting the masonry of the car; H, rails for the car; I, rollers, mounted upon axles, which receive their movement from the exterior; J, door, for placing and withdrawing the products; K, register door or vertical drawer; L, L, (Figures 3, and 4,) fire places; M, space for the circulation of the flame; N, outlet for the products of combustion; O, circular arch, in which the products circulate; P, shelves for the products; Q, car and its accessories; R, door, for placing and withdrawing the products.

CUPELS.

An important point among the modifications which I have introduced into this branch of the manufacture consists in the reception of the products after the stamping in cupels constructed of refractory materials, and having, if necessary, the hollowed form of the under part of the button, Figure 1, Sheet 7. This mode of reception presents, with regard to the process in use, very marked advantages as to cost, simplicity, and difference of work.

TEMPERING OVEN.

To remedy the inconveniences of a rapid withdrawal from the oven, I place the products in a channel A, B, Figures 3, and 4, Sheet 7, heated at its upper extremity only, either with the waste heat of one of the ovens, or with a special fire, and cooled at its lower part by a current of cold air C, D. The lower extremity of this channel is opened at will, to let out the products as they are cooled, and as is necessary to make room for new ones.

WASTE HEAT.

Working mechanically, and having to use a motive power, I apply to this manufacture the arrangements used in forges to make use of the waste heat of puddling furnaces, reverberatory, &c. &c., an application which has not yet been made to the manufacture of enamel buttons. In this application I make, below the generator, a cavity or fire capable of containing a certain quantity of bricks or different pieces of refractory earth, and I arrange the holes and registers so as to direct the flame of the fires either under the generator or in the ovens, or even in one first and then in another, by commencing at will by one of the two, in such a manner that for the drying of the bricks the furnace will receive it secondly, and for their baking it will receive it first, so as to direct it then under the cauldron.

OF THE BAKING BY GAS.

The improvement which I introduce in my mode of baking consists in substituting the direct action of the flame of any combustible gas for

1853

the heat afforded by coal, and which only reaches the products after having traversed a vault or a refractory plate. When I speak of any combustible gas whatever, I mean that the gas may be pure hydrogen or carburetted hydrogen, with a suitable quantity of atmospheric air added, or of pure oxygen gas, or even the product of the evaporation of volatile substances, such as alcohol, ether, essence of turpentine, oils, &c. &c., or, lastly, of many gases or vapours mixed together. I give here only some examples of application, for it is easy to perceive of how many varieties this new mode of baking is susceptible, either as regards construction of apparati, in the arrangement of the pipes for the entry and regulating of the different gases to be mixed, or as to the industrial result, according as hydrogen, air, or oxygen predominates; that is to say, according as the flame is rendered reduisante, oxidante, or neuter. Thus, to give an idea, a button containing oxyde of copper will become green by the oxidante flame, and red by the reduisante flame; with the oxyde of iron it will become yellow by the oxidante flame, and black or dark green by the reduisante flame. These different examples will suffice to show the multiplicity and the diversity of the applications that are possible here, and how difficult it would be to specify them in detail. I do not confine myself to the details which I have expressed, but to the discovery of baking paste and enamel buttons, of all kinds, by the direct action of the flame of any gas whatever. Hydrogen, pure or carburetted, and air or oxygen, are received separately, each in a small gasometer A, which is for the purpose of regulating the pressure, so as to furnish a determinate volume of the two gases. These gases, of which the respective quantities may be increased or diminished at will by aid of cocks B, suitably arranged, go separately to a little gasometer C, of the capacity of about three quarts, containing an agitator D, constantly put in motion. It is in this little gasometer that the mixing is effected; and, as this mixing is explosive, the tube in communication with the tubes for combustion is furnished with metallic sheets E. I will add, that the little gasometer may be dispensed with, whilst the gaseous mixture may be made with facility in the tube containing the metallic sheets (see Figures 11, and 12, Sheet 7). The orifice whence the gaseous jet escapes is composed of an union of little capillary tubes F, (Figure 7, Sheet 7,) more or less near, and more or less in number, so as to present a little greater surface than the surface of the buttons to be baked. This arrangement of little tubes turns constantly in a horizontal plate G, so as to extend the heat at the point of the baking, that the button may be gradually heated, and that it may not be suddenly acted upon by the jet of flame from the turning tubes. I arrange before and after this jet of gas either a series of small burners H, less powerful and graduated, or two conduits I, heated exteriorly to raise and lower the temperature of the button gradually. The heat may likewise be uniformly extended by turning the product, and leaving the furnace stationary. In this case, it may be of a form analogous to the Figure 7 bis, Sheet 7. If the gas which escapes is not supposed explosive, the division should be considered as being made by a jet of hydrogen gas. The division following and immediately contiguous will be completely similar, and will permit to escape, as is necessary, either the air or the oxygen, and thus a third division if a third gas is necessary. Each of these rows, which are repeated as many times as the size of the apparatus demands, is regulated by cocks on purpose for them. For this second apparatus the endless chain upon which the cupels are placed receiving the buttons should, if the product requires it, bear little circular plates, having a rotary movement, to ensure, with regard to certain delicate arrangements, a sufficient uniformity of temperature. This apparatus affords every guarantee and fulfils all the conditions of a perfect manufacture; it permits of baking all kinds of buttons with holes, and even buttons with shanks, as will be seen presently, by the

MOULDING IN A HOT STATE.

From the analysis or decomposition which I have made of the porcelain paste, and the new elements which I have substituted for it, it results that I have enriched my manufacture in all branches of the ceramic art; that is to say, that by the aid of different proportions I find that I make use of the baked earth, and of the most vitreous substance; only, as my mixtures are of a nature to be treated only by moulding, in the first instance, by cold, and the subsequent baking, I

1853

effect it by instruments which I have described previously; but since, by its proportions, my composition enters into the series of fusible materials, I treat it by different processes, which I will describe.

CASTING BY GRAVITATION.

The apparatus is composed of a vessel A, of refractory earth, having nearly the form of a mortar, and placed in a furnace B, so as to allow of the temperature of the vessel being raised to a suitable point. The lower part of the vessel is pierced with a little circular opening O, and the vessel upon a stand C, also pierced with a hole corresponding to that of the vase, the prolongation of which, in sheet or cast iron, crosses the masonry or the ash-pit of the furnace. The opening pierced in the bottom of the vessel is shut by the aid of a ring of iron, covered with refractory earth, the conical extremity of which is engaged partly in the hole O, and thus performs the office of a valve, Figure 7, Sheet 6. The material which is to be operated on is introduced into the vessel by holding the valve closed; then, when the whole is in fusion, and the vitreous material is suitably purified, that is to say, deprived of bubbles, the rod causing the valve to work is raised more or less, the pouring out takes place, and a drop E, which can be made greater or less at will, falls. This drop tends to fall more easily, as, in elongating, it draws out; and, being in a high temperature, the little stream melts it, and makes the drop take a spherical form. By receiving this drop, which continues for a long time at its red heat, upon a metallic plate F, having a little division, in which a shank q, is placed, slightly exceeding the plate, the shank becomes fixed in the drop of vitreous material E, and thus a button with a shank K, is obtained. As nothing is easier than to arrange the apparatus so that the drop may always fall exactly in the same place, and consequently always upon a shank, this manufacture offers no difficulty, and it may be understood that by suitably regulating the play of the valve, and that of the plate receiving the drops, buttons of various sizes may be obtained.

MOULDING BY THE MOULD.

If, instead of receiving the drops of vitreous material upon a shank placed in a little cavity, they are received in a hollow mould presenting the form of the lower part of a button, and that immediately after its fall, the mould being supposed hot, a piercer, presenting the hollow impression of the upper part of a button, is applied, the vitreous mass, by a light pressure even, will exactly fill the cavity comprised between the stamp and the mould, if, at the same time as the pressure is made, four small steel rods are arranged, so as to penetrate into the soft mass; or, even if the arrangement of moulds for buttons with rounded holes, and the blowing of the air, is adopted, and the mould and stamp arranged so as to cut the seam occurring from the excess of the material, a button with holes remarkable for the purity of their form is obtained. This mode of manufacture allows of producing upon buttons the most elaborate designs; it is sufficient to engrave them upon the stamp, and the exact imitation of the designs produced by weaving presents no difficulty. It will, moreover, be understood that either to buttons with holes or with shanks, all forms and all imaginable appearances may be given mechanically by the aid of the stamp and the mould, engraving, carving, and engine turning, chemically, and by the composition, and the color of the vitreous material. The same arrangement of vessel will serve also for the preliminary fusion of the materials.

I may here allude to the baking by gas, which allows also of manufacturing buttons with shanks, as will be seen. The vitreous matter is reduced into a very thick powder; the shank is fixed in a little groove made in a piece of charcoal, or in a plate covered with sulphate of lime, or any other isolating substance; this hole is placed at the bottom of a little cavity. The shank, exceeding the hole slightly, is covered with a certain quantity of vitreous material; then the whole is submitted to the jet of gas, until completely fused. The perfectly vertical direction which can be given to a jet of gas allows the glass to take a spherical form, and the shank becomes soldered to the button. If the button is to receive an impression, the mould which bears this impression must be placed, either mechanically or by hand, upon the soft sphere which the glass forms, at the moment when it is sufficiently soft to penetrate into the fine parts of the engraving.

OF THE PASTE OR MATERIALS.

Hitherto the felspar of oxide of iron, employed pure, or even with a variable quantity of kaolin, added with some slight quantity of chalk,

1853

potash, or soda, has formed the base of the different qualities of buttons called in commerce by the names of paste, agate, opal, porcelain, &c. This substance, from the absence of terreous or metallic oxyde, and the insufficient quantity of alkali which it contains to form a compound fusible at a moderate temperature, requires, in consequence of its nature, a considerable quantity of caloric, which can only be obtained at a very great expense of combustible material, and which, besides this direct and immediate expense, is a cause of the very rapid deterioration of furnaces, and the frequency of their repairs. It is to remedy this double inconvenience that I have undertaken a series of researches for the purpose of replacing felspath (silicate of alumina and natural potash) by one or more silicates, simple or composed artificially, and to which I can give, by the aid of an addition of natural silicates, salts, oxydes, or any other substances whatever, the hardness, tenacity, fusibility, appearance, or colour desired. I can also use the felspath, kaolin, and other natural silicates, by introducing a suitable quantity of alkaline base, terreous or metallic, to produce silicates easily fusible. For this purpose I transform them by the aid of fusion, or simply of a burning, into a perfect glass or crystal.

The artificial, simple, or multiple silicates, no matter what their chemical composition, always form a vitreous, glassy, crystal, or enamel matter, or at least a vitrifiable material, the manufacture of which is already well known; but the application of these substances, pure or mixed, has not yet been made to the mechanical manufacture of buttons with holes or shanks. All vitreous substances, in general, which industry produces for various purposes, may be employed in this new kind of manufacture. The glass for windows, the glass for looking glasses, the glass for bottles, crystal, glass for drinking, colored crystals and enamels, &c., formed the primary matter, either as I use them in the state of waste or rubbish, or as I manufacture them specially for this work. To vary the appearance of the buttons, to color them, or give them a great hardness, I add to the vitreous matter certain metals, very divided: oxydes, acids, chlorides, bromides, iodides, fluorides, sulphurs, phosphorus, &c., metallic terreous salts, natural silicates or mineral substances, often very complicated or even organic substances or salts. If it is desired to vitrify the matter, I have recourse to the substances which tend to take possession of the alkali, as, for example, silica, in fine powder, kaolin, &c. I can likewise obtain this result by heating in cement the moulded buttons, by the aid of machinery. Reaumur, for the porcelain which bears his name, operated in this manner; but I prefer to mix directly with the silicate in powder the vitrifying materials, the proportions of which I can vary, besides, according to the composition of the glass. If I desire to obtain a contrary result, I have recourse to an addition of potash, soda, oxyde of lead, zinc, bismuth, &c., which oppose themselves efficaciously to the vitrification. To obtain different colours, I add directly to the vitreous material in powder, certain oxydes or metallic and terreous salts, such as peroxyde of iron, the sesquioxydes of chromium, the sulphate of iron, the pyrophosphates, &c. &c. The others, by reason of the disengaging of gas, occasion a bubbling in the mass; I obviate this inconvenience by a burning, and even sometimes by a preliminary fusion. This is what I do with regard to the carbonate of lime, oxyde of cobalt, of almost all the nitrates, carbon, organic substances, &c., which produce this result. To obtain white or colored products having particular properties, I mix felspar, certain volcanic and argilaceous materials, fractions of porcelain and colored pottery, slate, &c., &c., with the powder of glass or crystal. The manufacture besides is of a greater simplicity; glass, crystal, or enamel are reduced to powder; then the substances for modifying their qualities or appearance are added, the proportion of which varies from 1 to 20%. The intimate mixing may be made wet or dry. If the substance introduced produces a bubbling, it is to be burned for a quarter of an hour, or half an hour, or even melted completely; it has then to be pulverized again. It is evident that only one pulverization can be made for the specially prepared silicates, since all the substances which enter into their composition are immediately added. The powder, slightly wet, is moulded perfectly into buttons, and better than felspar; it requires consequently no special preparation. As these vitreous materials melt at a moderate temperature, the baking of these new buttons can be effected by dark red to light red heat; but it is effected ordinarily by a cherry red heat, and requires on an average three to six minutes. An essential condition is the uniformity of heat, and the slow gradation of temperature of the

1853

ordinary red heat. The continuous circular furnace, which we have previously described, leaves nothing to be desired with this regard.

Not only by aid of the above-described process can all qualities of buttons which felspar can give, be obtained, but many of these products are gifted with properties entirely new. These results certify, that the buttons obtained with artificial silicates, pure or mixed, will surpass those of the old method of manufacture, and will be preferred to them. As may be seen, the principal object of this Invention consists in the obtaining and the composition of primary material fit for the manufacture of buttons, composed essentially of silicates obtained artificially, by replacing felspar and other pastes called ceramic, employed at the present time. The result of which is, 1st, a lower baking temperature, more rapid, more economical, and less deteriorating to the furnaces; 2nd, a reduction in the cost of the primary materials; 3rd, the use of an infinity of oxides or other coloring substances, decomposable at a high temperature, although perfectly resisting to the temperature which the baking of the buttons requires; 4th, the possibility of modifying, ad infinitum, and at will, the different component parts, to obtain varieties in the product infinitely more numerous; 5th, the production of a large quantity of my primary materials, by the simple mixing of the constituent principals which enter into the composition of these materials, without being obliged to have recourse to a preliminary fusion; the combination in this case taking place at the time of the baking of the buttons.

This part of my Patent is intended, then, for the manufacture of buttons, having for their base the silicates and boro-silicates, simple or multiple, pure, or with the addition of other salts or substances whatever, and obtained by art, either by aid of the direct combination of the constituent principles of these silicates or boro-silicates, or by the aid of natural silicates and other salts or minerals, suitably combined to produce a vitrifiable mass.

SUMMARY.

I sum up that part of my description which relates to the new products which I manufacture, by insisting upon the important point of the rounding of the edges of the holes, not only as regards the industrial improvement which it constitutes, and the material advantages which result therefrom to the consumer, but also because it is the sole exterior distinctive character, by the aid of which I can distinguish my products.

Regarding the machines, the new points of my improvement consists in the completely mechanical manufacture of a product which has not been obtained till the present time, except by numerous apparati; that is to say, worked, directed, and supplied by manual labour. Likewise, as to the machines, it is principally the industrial result which I patent, as the greater part of the means which unite in its realization might be advantageously applied distinctly in numerous machines. I allude to them in this summary, to make it well understood, that they are not only in their combination, but each separately, my Invention. These principal points are,—1st, the stamping in a double collar, the machine being for one button or multiple, as it may be worked by hand or by power. 2nd, the pressure uniformly regulated and dynamometrically limited. 3rd, the piercing by the compressed air, the vacuum, and the rounded and clear forms, with or without the help of the vacuum. 4th, the deposit and the direct arrangement of the products upon the plates and upon the baking cupels, either in the place of the stamping or beyond the place of pressure. 5th, the mechanical movement of the receiving plates or cupels. 6th, the introduction of the cupels in the manufacture of ceramic buttons. 7th, the mechanical distributor, either as it works in the machine or outside it, or with the aid of a carrier, or with the removal of the instrument. 8th, the agitator, and the single or multiple rods. 9th, the simultaneous action of many different operations. 10th, the circular mould bearers, having the moulds parallel to the axis, and working horizontally or slanting, and working upon the circumference of the circle. 11th, the mechanical movement of the screw presses used for the buttons.

For the preparing apparati, a rotative mortar, with eccentric pestle, without application of the rush of the air.

Lastly, an improved mixing apparatus.

Regarding the baking and the ovens, for the manufacture of paste and enamel buttons, the improvements are,—First, the motion, either circular, rectilinear, horizontal, vertical, or inclined, of the products in a channel heated exteriorly, and open at the two extremities for the

1853

placing and withdrawing of the same. Secondly, the employment of the waste heat. Thirdly, the intermediate use of the tempering oven. Also the application of gas for baking buttons, whatever may be the nature of the gas and the mode of its application; that is to say, the gas may act directly upon the products, or it may act by the intervention of a body interposed between the flame and the product.

As regards the moulding in a hot state, the compositions of the paste may have a greater or less vitreous character, of which I avail myself to introduce the hot casting. It is, then, the fact of this hot casting, either manual or mechanical, applied to buttons that I claim. That which characterizes the paste consists in the fact, that more or less fusibility can at will be communicated to it; and, consequently, it may be baked at a more or less elevated temperature, and, independently of this property, it may be combined at the time of its baking by a simple preliminary mixing with a mass of substances serving to modify its properties and its colour; and, lastly, it may be obtained in certain cases by the simple mixture of the different parts which constitute it, without having recourse to a preliminary fusion. That is to say, that this Patent includes six principal branches of improvement, viz.:—

A new product. A new arrangement of machine for the cold stamping. A series of preparatory apparatus. A furnace, and a new mode of baking by gas. The introduction of a hot moulding. And, lastly, a new composition of paste.

I claim the method of manufacturing paste and enamel buttons, as herein described, and of which the principal points are specially indicated in the foregoing summary.

In witness whereof, I, the said Constant Jouffroy Duméry, have hereunto set my hand and seal, this Tenth day of October, in the year of our Lord One thousand eight hundred and fifty-three.

C. J. DUMÉRY. (L.S.)

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